LEAN BLADE REPAIR PILOT

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Outline

- **Problem**
- **Approach**
  - **Modeling/Re-engineering**
  - **Blade Inventory Tracking System (BITS)**
  - **Advanced Manufacturing**
- **Payoff**
- **Summary**

Problem/Challenge

- **Large number of parts (640K)**
  - Engines from 3 services
    - » AF, NAV, FMS
  - Multiple engine types
  - Multiple engine series
  - Accountability
- **Costly repair operations**
  - Rework
  - Scrap
- **Long travel/cycle times**
  - 8 miles
  - 111 days
  - Mission capability
  - Customer satisfaction

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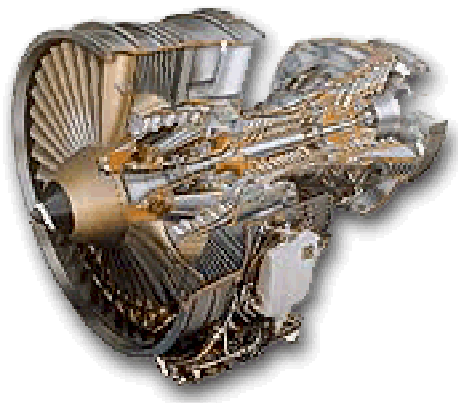

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HPT

Objective/Approach

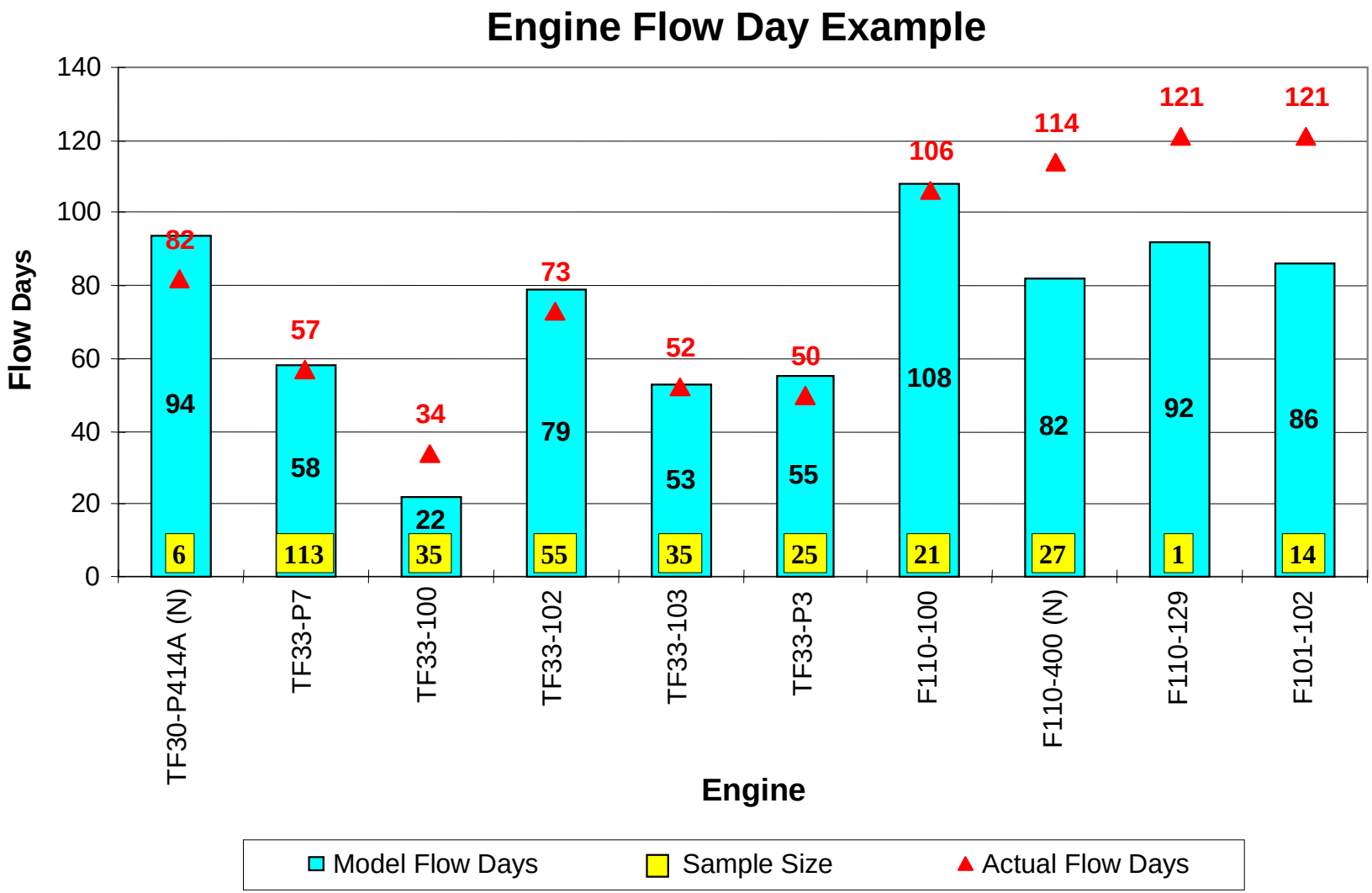
- **ESTABLISH A LOW COST HIGH QUALITY "LEAN" REPAIR CAPABILITY WITHIN THE INTEGRATED BLADE REPAIR CENTER (IBRC)**
- **MODELING AND RE-ENGINEERING**
  - Model Propulsion Production Branch process shops
  - Recommend improvements to reduce repair flowtime, increase capacity, and optimize resource utilization.
  - Implement approved recommendation
  - Release product to OC-ALC
- **BLADE INVENTORY TRACKING SYSTEM (BITS)**
  - Add a serialized blade tracking and repair history database capability
  - Upgrade IBRC material handling and inventory management system
  - Add a workload scheduling capability
- **ADVANCED MANUFACTURING (LEAN PRODUCTION)**
  - Reduce non-value added tasks and reduce repair flowtime and cost

Objective/Approach

Modeling and Re-Engineering

- ***Three tier model***
  - ***Base level***
  - ***Front shop level***
  - ***Back shop level***
- ***Modeling is a management tool with application to the dynamics of engine and component repair***
  - ***Analysis at the operation level (model a machine) or at the enterprise level (model the facility)***
  - ***Insight into interactions among disassembly, repair, assembly and supply functions***
  - ***Assess impact of workload, equipment and manpower changes***
  - ***Identify constraints and bottlenecks***
  - ***Investigate alternative solutions BEFORE committing dollar resources***
  - ***Strategic or tactical applications***

Model Verification



Blade Inventory Tracking System (BITS)

BITS IMPROVES MANAGEMENT CAPABILITY

Shop floor process tracking
- Data quality
- Data quantity
- Information flow
- Serialized tracking

Operations management from the desktop
- Real time load management
- Visibility into process
- Enhanced capability

Status
- Installation/check-out complete
- Training planned

Blade Inventory Tracking System (BITS)

Manufacturing Technology
USAF

Payoff

INITIAL RESULTS

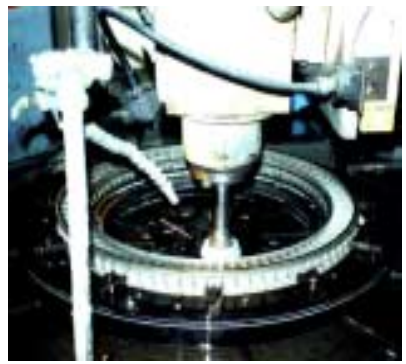
- **$7M Total Avoidance**

- **Other Benefits**
  - On time delivery
  - Serialized tracking capability
  - Flexibility to reconfigure part flow
  - On-Line Reporting
  - Engine overhaul cycle time reduction

Advanced (Lean Cell) Manufacturing

Verification

- **Complex long-duration repair made LPT1 nozzle a prime candidate for lean production**
  - **10 industrial processes**
  - **208 process steps**
- **Over 8 miles of travel distance per part**
- **Results of simulation runs verified LPT1 nozzle is on critical path**
- **Potential exists for significantly reducing nozzle repair time**
- **Critical Path Analysis will identify similar parts for comparable improvements**






Advanced (Lean Cell) Manufacturing

Manufacturing Technology USAF

Payoff

PRELIMINARY COST AVOIDANCE

(*All costs in FY1999 dollars)*
(Nozzles & Stators)

		As-Is	Lean Cell	Net Avoidance
Reduced Repair Cost (Ten Year Totals)	Nozzles:	$ 16.6M	$ 12.0M	$ 4.6M
	Stators:	$ 49.9M	$ 33.0M	$ 16.9M
	Total:	$ 66.5M	$ 45.0M	$ 21.5M

Reduced Flow Time (Calendar Days)	Nozzles:	110+ days	55 days	50% reduction
	Stators:	90+ days	15 days	80% reduction

Space Savings (Shop floor)

10,200 sq. ft. Total space savings

Advanced (Lean Cell) Manufacturing

Manufacturing Technology
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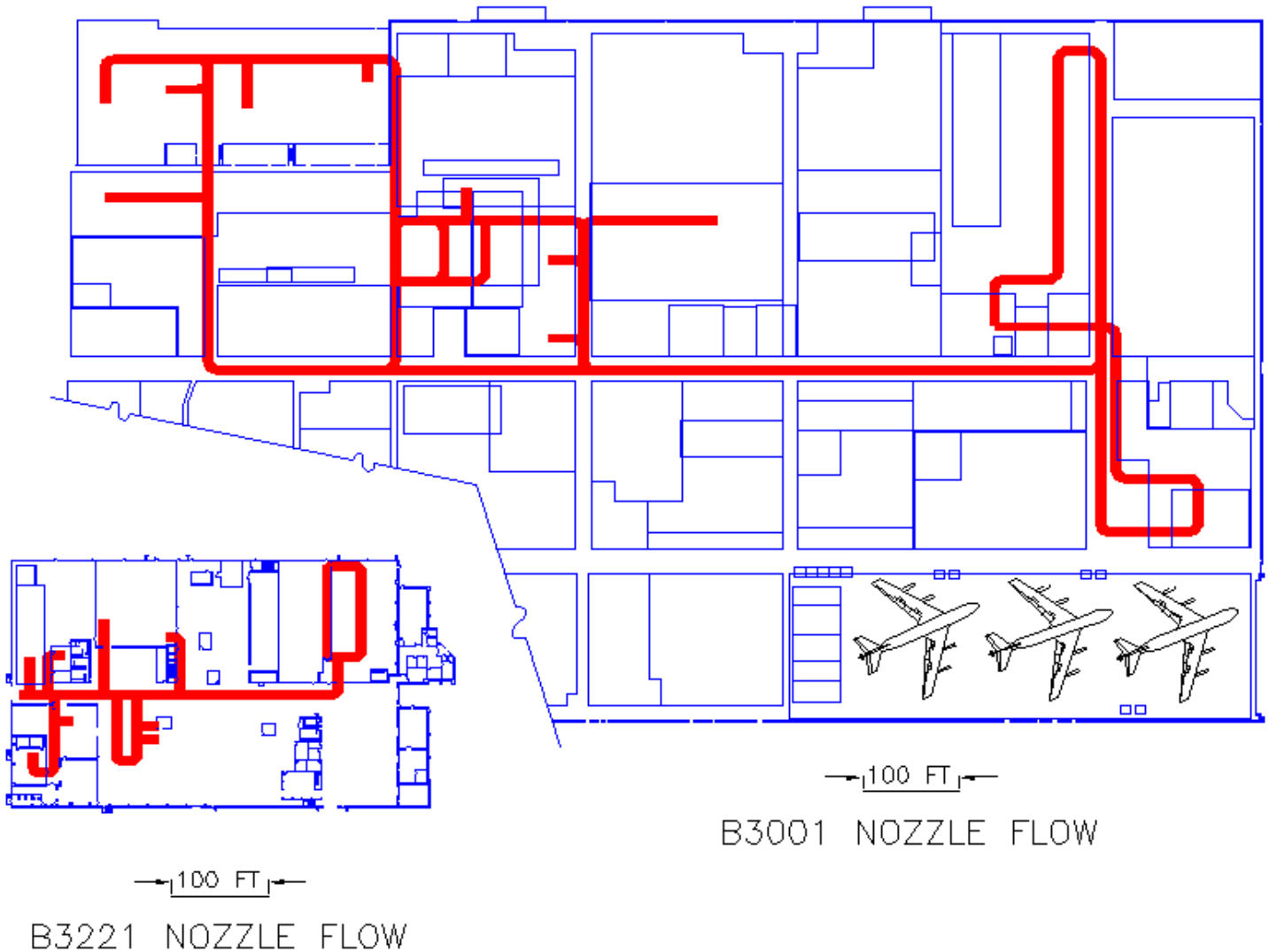
Payoff



Summary

- **Analytical Tool**
  - **Objective Decision Making**
  - **Verifies Critical Components**
- **Tracking System**
  - **Seamless Flow**
  - **Visibility into Shop**
  - **Accountability**
- **Reduce Waste**

Lean Blade Repair Pilot

Manufacturing Technology
USAF

Objective

Establish a low cost, high quality “LEAN” blade repair capability for advanced propulsion systems

Approach

- Model repair process enterprise with witness software
- Develop analytical tool box
- Identify engine/blade repair requirements
- Implement advanced manufacturing concepts
- Develop Blade Tracking System

Deliverables

- Computer model/analytical tool box
- Automated serialized blade tracking system
- Lean manufacturing/repair capability

Contract Background

- **Jointness:** Air Force and Navy Engines
- **Execution:** Air Force
- **Contractor #:** F33615-93-C-4301
- **Contractor/Location:** General Atomics/San Diego CA
- **Start Date/End Date:** Aug 93/Feb 01
- **Project Engineer:** Rafael Reed

	Prior	FY98	FY00	FY01	Total
MT Funds ($K)	3,933		1,188	637	5,758
PRAM ($K)	2,707	7,197			9,904
					15,662

Implementation/Customer

Implementation at OC-ALC, Tinker AFB OK, Bldgs 3221/3001.

Benefits

- Technical and BP&P (Total Enterprise Approach)
- Eliminate non value added activities
- Reduced scrap
- Reduced cost of component overhaul
- Reduced overhaul cycle time
- Enhanced capability to process advanced thin walled blades

Related Efforts

- Lean Aircraft Initiative
- Lean Sustainment Initiative